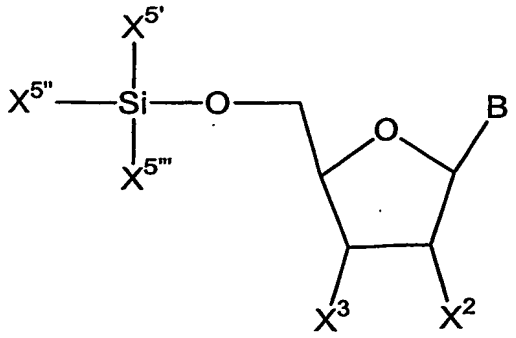
WHAT IS CLAIMED IS:

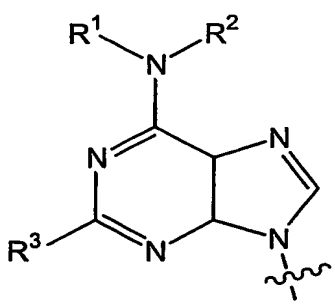
1. A protected monomer having a formula (I)



(I)

wherein,

B is selected from the group consisting of: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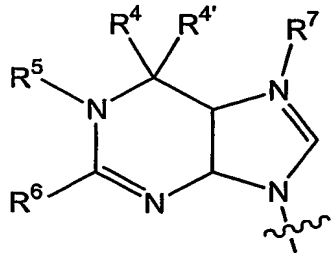
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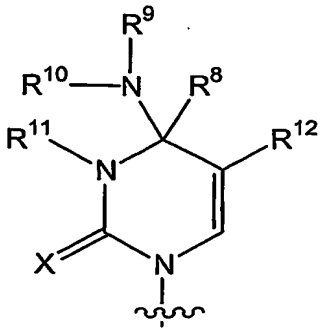
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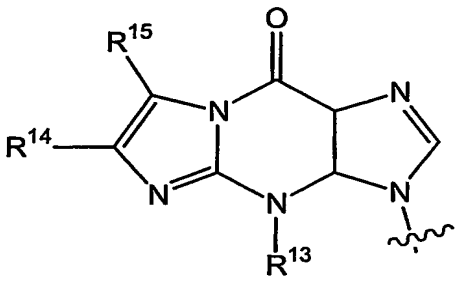
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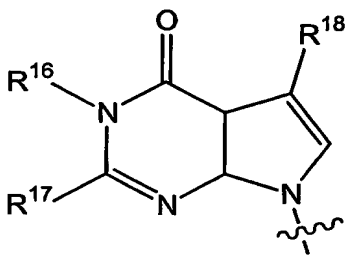
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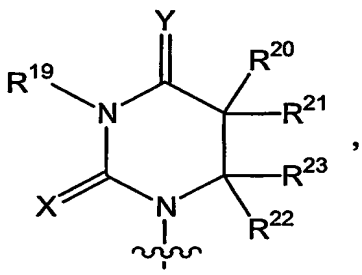
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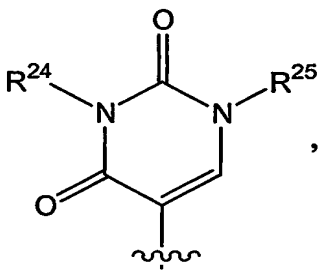
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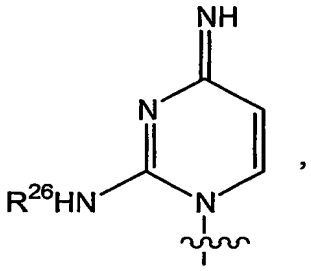
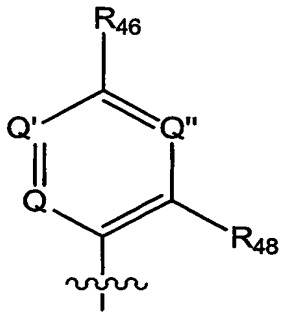

,

anthracenyl, pyrenyl,



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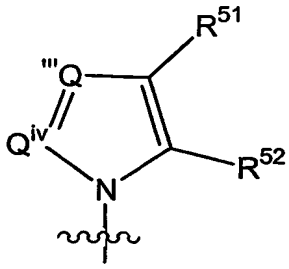

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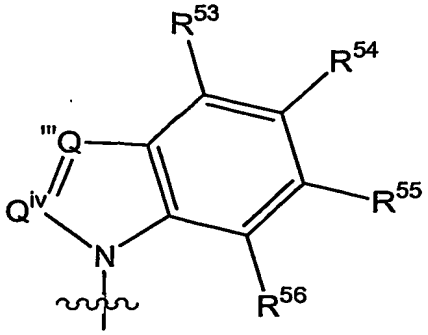

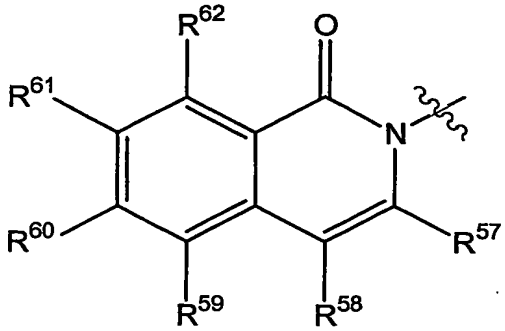

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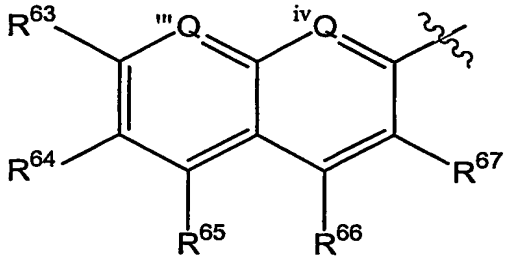
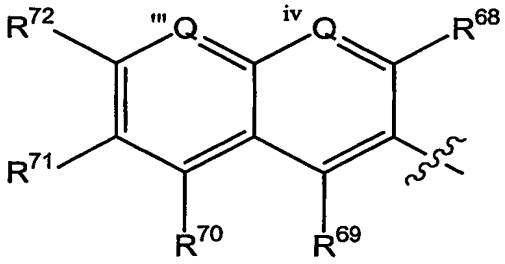


, and



;

X^2 is an ortho ester protecting group, hydrogen, ethers, alkyl ethers, esters, halogens, protected amines, or protected hydroxyl moieties;

X^3 is -O-P(OR^{27})N(R^{28})$_2$ or -O-L-R^{29};

$X^{5'}$, $X^{5''}$, $X^{5'''}$ include at least one alkoxy or siloxy substituent;

R^1 is hydrogen or C_1-C_4 alkyl;

R^2 is hydrogen, C_1-C_4 alkyl, or C_2-C_6 alkenyl optionally substituted with hydroxy, or C(O)NHR^a;

R^3 is hydrogen, halo, C_1-C_4 alkyl, C_1-C_4 thioalkoxy, NH_2, NHR^b, or N$R^b R^c$;

R^4 when taken together with $R^{4'}$ forms oxo, or R^4 when taken together with R^5 forms a double bond between the carbon and nitrogen atoms to which they are attached;

$R^{4'}$ when taken together with R^4 forms oxo, or is O^-;

R^5 is hydrogen, C_1-C_4 alkyl, or when taken together with R^4 forms a double bond between the carbon and nitrogen atoms to which they are attached;

R^6 is hydrogen, halo, NH_2, NHR^b, or NR^bR^c;

R^7 is an unshared electron pair, or C_1-C_4 alkyl;

R^8 when taken together with R^9 forms a double bond between the carbon and nitrogen atoms to which they are attached, or R^8 when taken together with R^{11} forms a double bond between the carbon and nitrogen atoms to which they are attached;

R^9 is hydrogen, C_1-C_4 alkyl, or when taken together with R^8 forms a double bond between the carbon and nitrogen atoms to which they are attached;

R^{10} is hydrogen or is absent;

R^{11} is hydrogen, C_1-C_4 alkyl, or when taken together with R^8 forms a double bond between the carbon and nitrogen atoms to which they are attached;

R^{12} is hydrogen, formyl, or C_1-C_4 alkyl optionally substituted with hydroxy or protected hydroxy;

R^{13} and R^{14} are each independently hydrogen or C_1-C_4 alkyl;

R^{15} is hydrogen, C_1-C_4 alkyl, or $(CH_2)_nCH(R^d)CH(NHR^e)(COOR^g)$;

R^{16} is hydrogen or C_1-C_4 alkyl;

R^{17} is halo, NH_2, NHR^b, or NR^bR^c;

R^{18} is cyano, $C(=NH)NH_2$, or $CH_2NH(R^h)$;

R^{19} is hydrogen, or C_1-C_4 alkyl;

R^{20} is:

(i) hydrogen;

(ii) hydroxy or protected hydroxy;

(iii) C_1-C_4 alkoxy optionally substituted with $COOR^f$; or

(iv) C_1-C_4 alkyl optionally substituted with hydroxy and/or $COOR^f$, NH_2, NHR^m, or $CONH_2$;

R^{21} is hydrogen, or when taken together with R^{23} forms a double bond between the carbon atoms to which they are attached;

R^{22} is hydrogen;

R^{23} is hydrogen, or when taken together with R^{21} forms a double bond between the carbon atoms to which they are attached;

R^{24} and R^{25} are each, independently, hydrogen or C_1-C_4 alkyl;

R^{26} is $(CH_2)_nCH(R^d)CH(NHR^e)(COOR^g)$;

R^{27} is C_1-C_6 alkyl optionally substituted with cyano, or C_2-C_6 alkenyl;

R^{28} is C_1-C_{10} alkyl;

R^{29} is a liquid or solid phase support reagent;

Q is N or CR^{44};

Q' is N or CR^{45};

Q'' is N or CR^{47};

Q''' is N or CR^{49};

Q^{iv} is N or CR^{50};

R^{44} is hydrogen, halo, hydroxy, nitro, protected hydroxy, NH_2, NHR^b, or NR^bR^c, C_1-C_6 alkyl, C_6-C_{10} aryl, C_6-C_{10} heteroaryl, C_3-C_8 heterocyclyl, a ligand, a tethered ligand, or when taken together with R^{45} forms $-OCH_2O-$;

R^{45} is hydrogen, halo, hydroxy, nitro, protected hydroxy, NH_2, NHR^b, or NR^bR^c, C_1-C_6 alkyl, C_6-C_{10} aryl, C_6-C_{10} heteroaryl, C_3-C_8 heterocyclyl, a ligand, a tethered ligand, or when taken together with R^{44} or R^{46} forms $-OCH_2O-$;

R^{46} is hydrogen, halo, hydroxy, nitro, protected hydroxy, NH_2, NHR^b, or NR^bR^c, C_1-C_6 alkyl, C_6-C_{10} aryl, C_6-C_{10} heteroaryl, C_3-C_8 heterocyclyl, a ligand, a tethered ligand, or when taken together with R^{45} or R^{47} forms $-OCH_2O-$;

R^{47} is hydrogen, halo, hydroxy, nitro, protected hydroxy, NH_2, NHR^b, or NR^bR^c, C_1-C_6 alkyl, C_6-C_{10} aryl, C_6-C_{10} heteroaryl, C_3-C_8 heterocyclyl, a ligand, a tethered ligand, or when taken together with R^{46} or R^{48} forms $-OCH_2O-$;

R^{48} is hydrogen, halo, hydroxy, nitro, protected hydroxy, NH_2, NHR^b, or NR^bR^c, C_1-C_6 alkyl, C_6-C_{10} aryl, C_6-C_{10} heteroaryl, C_3-C_8 heterocyclyl, a ligand, a tethered ligand, or when taken together with R^{47} forms $-OCH_2O-$;

R^{49} R^{50}, R^{51}, R^{52}, R^{53}, R^{54}, R^{57}, R^{58}, R^{59}, R^{60}, R^{61}, R^{62}, R^{63}, R^{64}, R^{65}, R^{66}, R^{67}, R^{68}, R^{69}, R^{70}, R^{71}, and R^{72} are each independently selected from hydrogen, halo, hydroxy, nitro, protected hydroxy, NH_2, NHR^b, or NR^bR^c, C_1-C_6 alkyl, C_2-C_6 alkynyl, C_6-C_{10} aryl, C_6-C_{10} heteroaryl, C_3-C_8 heterocyclyl, $NC(O)R^{17}$, or $NC(O)R^o$;

R^{55} is hydrogen, halo, hydroxy, nitro, protected hydroxy, NH_2, NHR^b, or NR^bR^c, C_1-C_6 alkyl, C_2-C_6 alkynyl, C_6-C_{10} aryl, C_6-C_{10} heteroaryl, C_3-C_8 heterocyclyl, $NC(O)R^{17}$, or $NC(O)R^o$, or when taken together with R^{56} forms a fused aromatic ring which may be optionally substituted;

R^{56} is hydrogen, halo, hydroxy, nitro, protected hydroxy, NH_2, NHR^b, or NR^bR^c, C_1-C_6 alkyl, C_2-C_6 alkynyl, C_6-C_{10} aryl, C_6-C_{10} heteroaryl, C_3-C_8 heterocyclyl, $NC(O)R^{17}$, or $NC(O)R^o$, or when taken together with R^{55} forms a fused aromatic ring which may be optionally substituted;

X is O, S, or Se;

Y is O or S;

L is $-C(O)(CH_2)_qC(O)-$, or $-C(O)(CH_2)_qS-$;

Provided that R^1, R^2, and R^3 cannot all be hydrogen; further provided that when R^5 is hydrogen, R^6 cannot be NH_2, NH(protecting group), or NH(iBu); further provided that when R^{12} is hydrogen and R^8 and R^{11} together form a double bond between the carbon and nitrogen atoms to which they are attached, R^9 and R^{10} cannot both be hydrogen; further provided that when X and Y are O, R^{19} is hydrogen, and R^{21} and R^{23} together form a double bond between the carbon atoms to which they are attached, R^{20} cannot be hydrogen or CH_3;

R^a is glycinyl, threonyl, or norvalyl, each of which may optionally be partially or fully protected;

R^b is C_1-C_6 alkyl or a nitrogen protecting group;

R^c is C_1-C_6 alkyl;

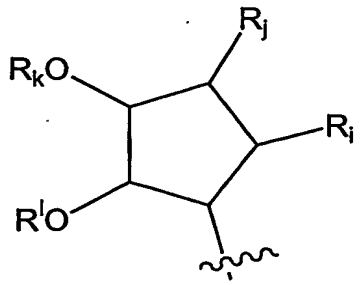
R^d is hydrogen, hydroxy, protected hydroxy, or OOH;

R^e is hydrogen, a nitrogen protecting group, or $COOR^g$;

R^f is hydrogen, or C_1-C_6 alkyl;

R^g is C_1-C_{10} alkyl;

R^h is hydrogen, or



R^i and Rj when taken together forms a double bond between the carbon atoms to which they are attached, or R^i and Rj when taken together form -O- between the carbon atoms to which they are attached;

R^k and R^l are each, independently, hydrogen, a hydroxyl protecting group,a sugar, or a fully or partially protected sugar;

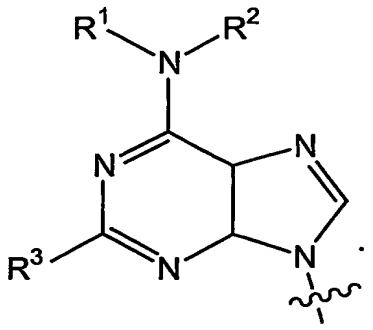
R^m is C_1-C_4 alkyl optionally substituted with COOH;

R^o is alkyl optionally substituted with halo, hydroxy, nitro, protected hydroxy, NH_2, NHR^b, or NR^bR^c, C_1-C_6 alkyl, C_2-C_6 alkynyl, C_6-C_{10} aryl, C_6-C_{10} heteroaryl, C_3-C_8 heterocyclyl, $NC(O)R^{17}$, or $NC(O)R^o$;

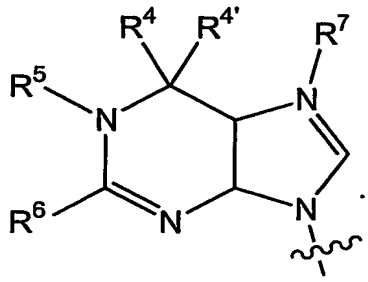
n is 1-4; and

q is 0-4.

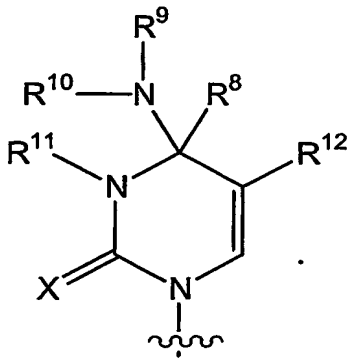
2. The monomer of claim 1, wherein B is:



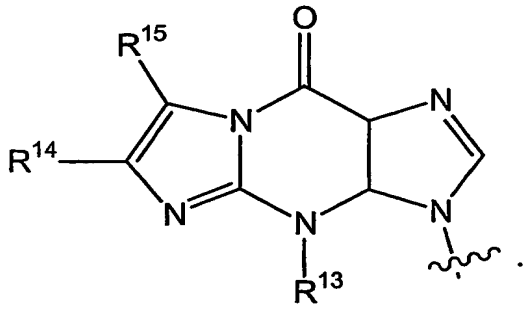
3. The monomer of claim 1, wherein B is:



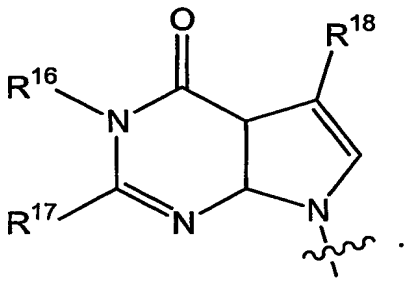
4. The monomer of claim 1, wherein B is:



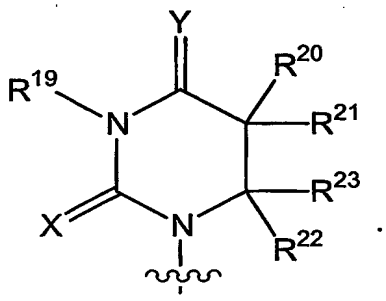
5. The monomer of claim 1, wherein B is:



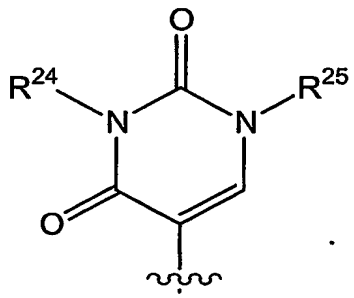
6. The monomer of claim 1, wherein B is:



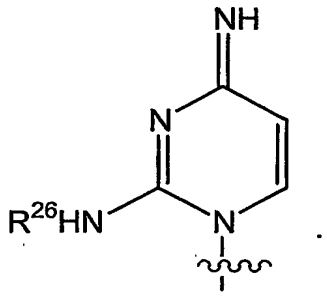
7. The monomer of claim 1, wherein B is:



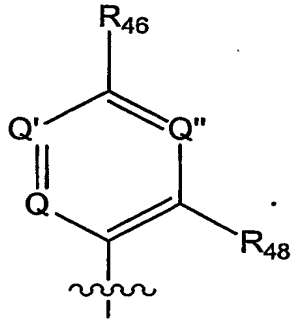
8. The monomer of claim 1, wherein B is:



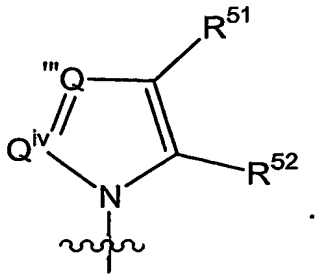
9. The monomer of claim 1, wherein B is:



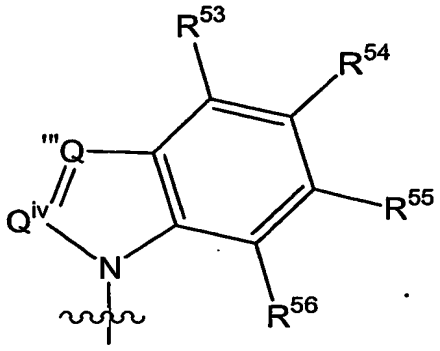
10. The monomer of claim 1, wherein B is:



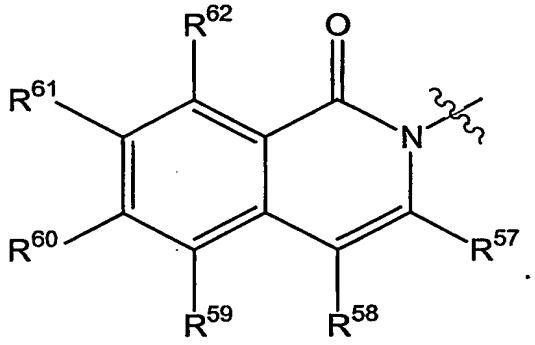
11. The monomer of claim 1, wherein B is:



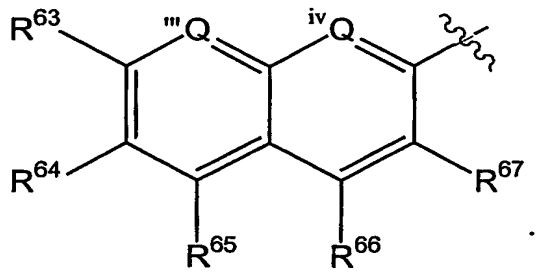
12. The monomer of claim 1, wherein B is:



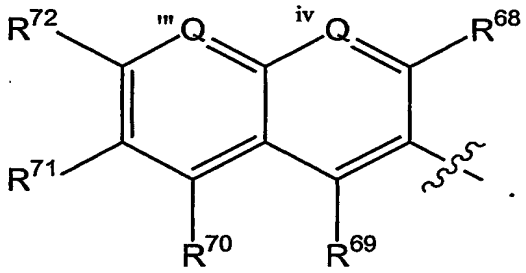
13. The monomer of claim 1, wherein B is:



14. The monomer of claim 1, wherein B is:



15. The monomer of claim 1, wherein B is:

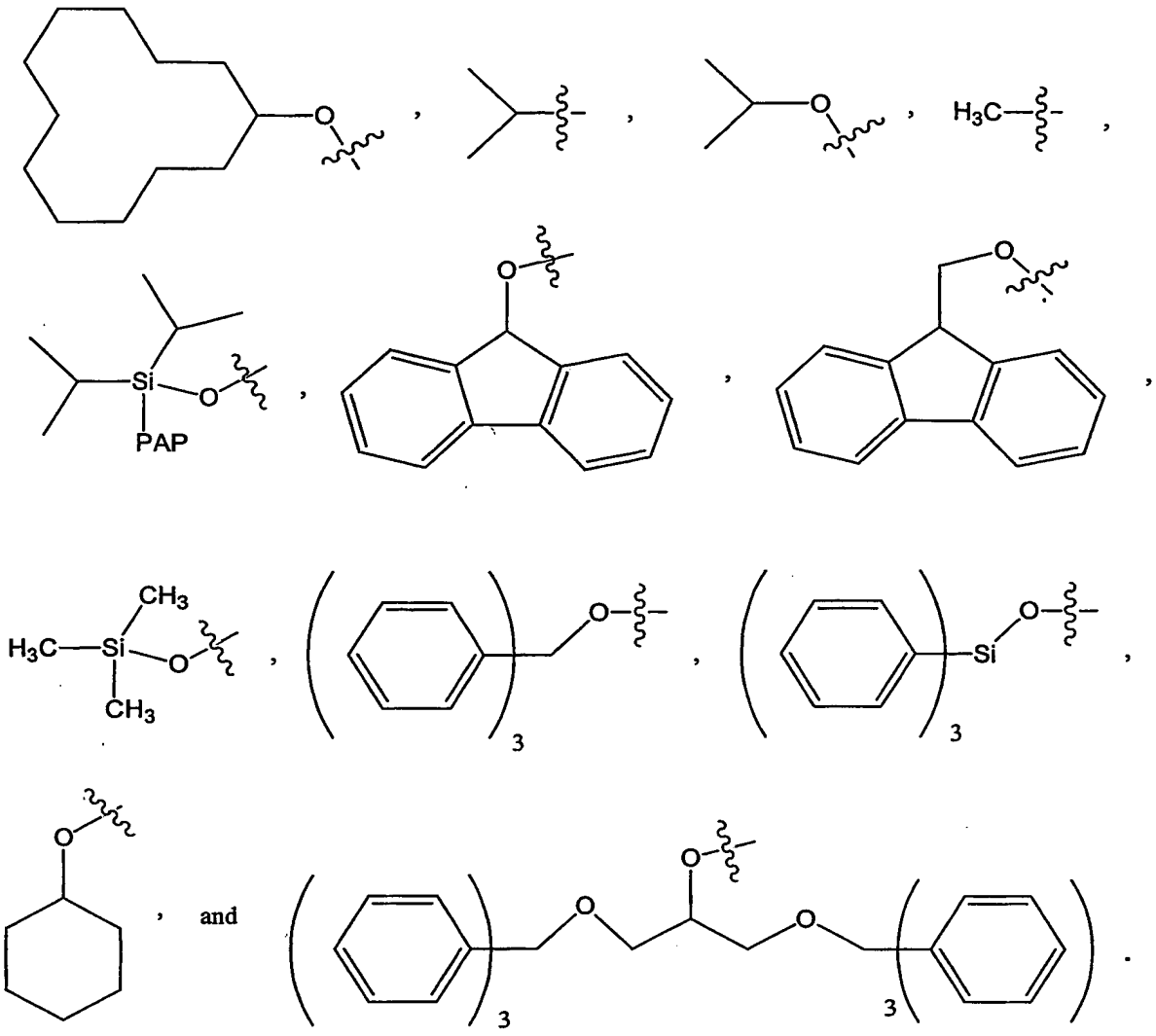


16. The monomer of claim 1, wherein B is anthracenyl.

17. The monomer of claim 1, wherein B is pyrenyl.

18. The monomer of claim1, wherein R^{28} is isopropyl.

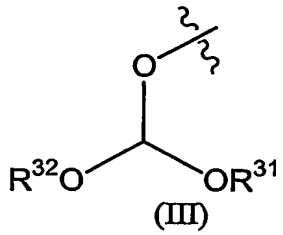
19. The monomer of claim 1, wherein $X^{5'}$, $X^{5''}$, and $X^{5'''}$ are any combination of the following formula:



and

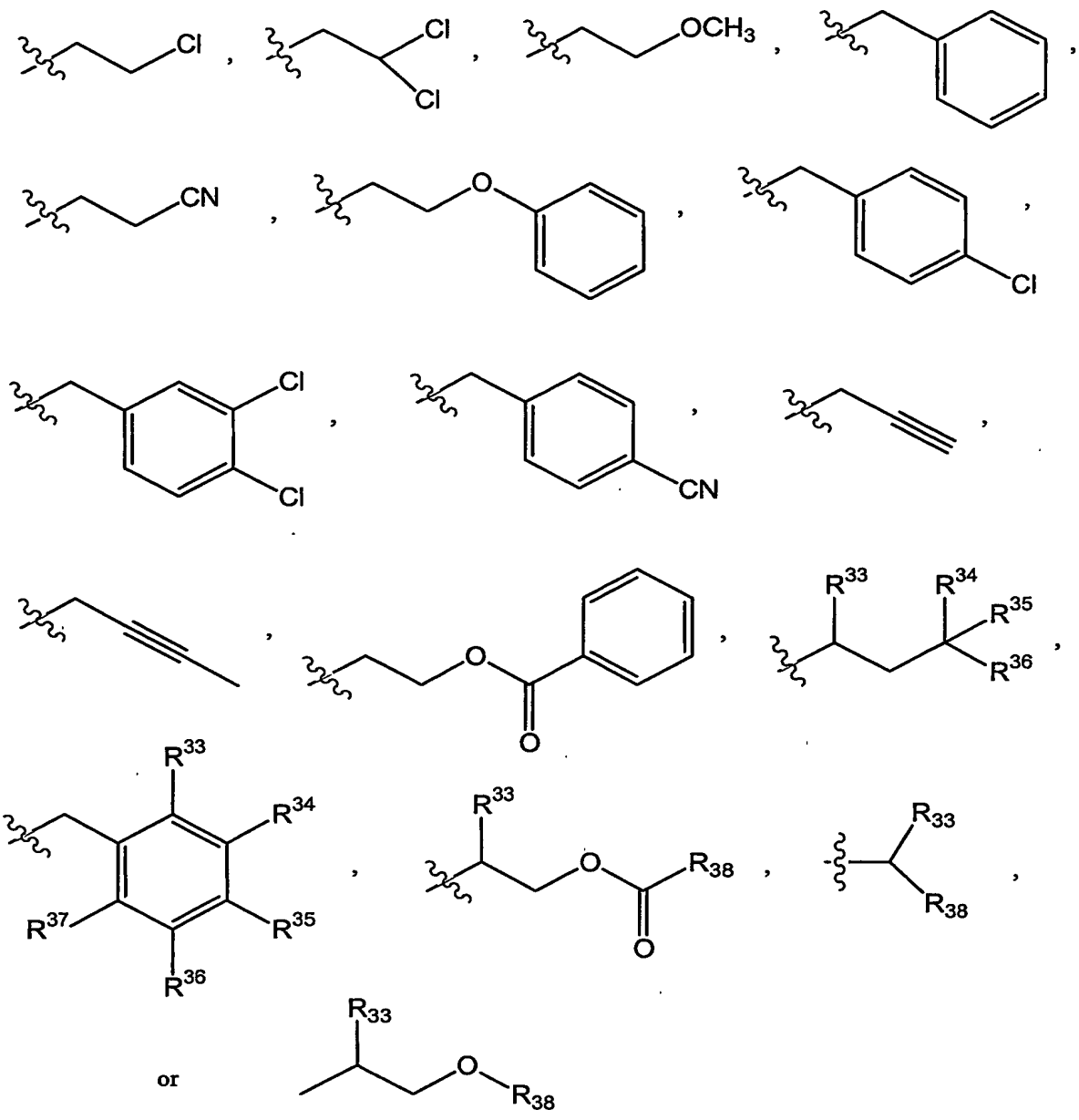
20. The compound of claim 1, wherein $X^{5'}$ and $X^{5''}$ are siloxy and $X^{5'''}$ is cycloalkoxy.

21. The monomer of claim 1, wherein the orthoester protecting group has a formula(III):



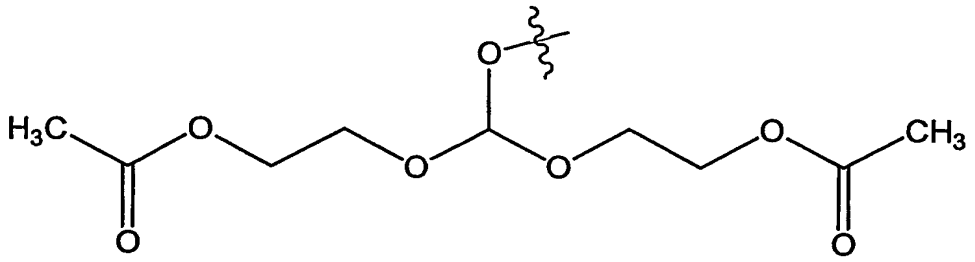
(III)

22. The monomer of claim 21, wherein R^{31} and R^{32} are the same or different and are any combination of the following formulae:



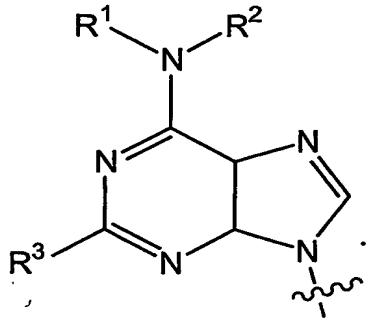
wherein R^{33}, R^{34}, R^{35}, R^{36}, and R^{37} is a compatible ligand, or hydrogen, or halogen, alkyl, or cyano substituent, and R^{38} is compatible ligand.

23. The monomer of claim 21, wherein the orthoester is:

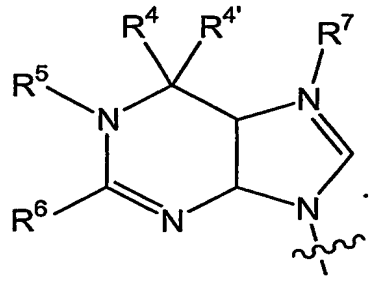


24. The monomer of claim 1, wherein R^{29} is a fluoride-stable polystyrene based solid support or PEG.

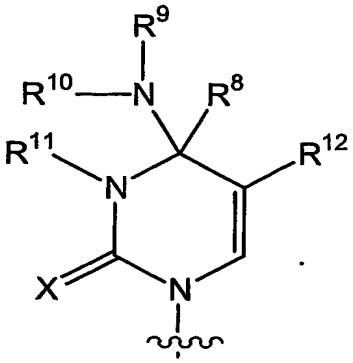
25. The monomer of claim 1, wherein X^2 is $-OC[OCH_2CH_2OC(O)CH_3]_2$; R^{27} is CH_3; R^{28} is $(CH_3)_2CH$-; X5' and X5" are trimethylsiloxy; X5"' is cyclododecyloxy; and B is:



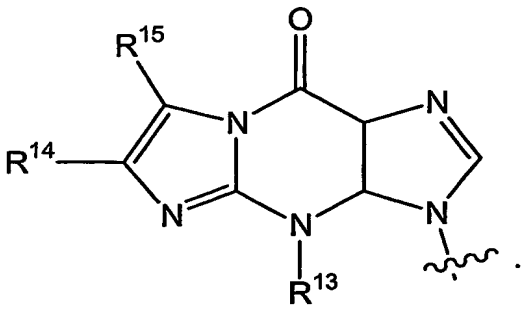
26. The monomer of claim 1, wherein X^2 is $-OC[OCH_2CH_2OC(O)CH_3]_2$; R^{27} is CH_3; R^{28} is $(CH_3)_2CH$-; X5' and X5" are trimethylsiloxy; X5"' is cyclododecyloxy; and B is:



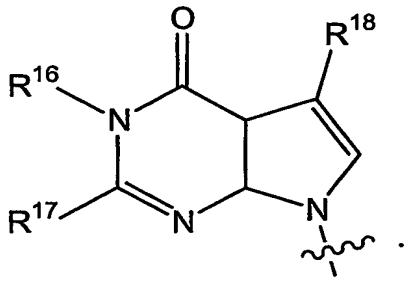
27. The monomer of claim 1, wherein X^2 is $-OC[OCH_2CH_2OC(O)CH_3]_2$; R^{27} is CH_3; R^{28} is $(CH_3)_2CH$-; X5' and X5" are trimethylsiloxy; X5"' is cyclododecyloxy; and B is



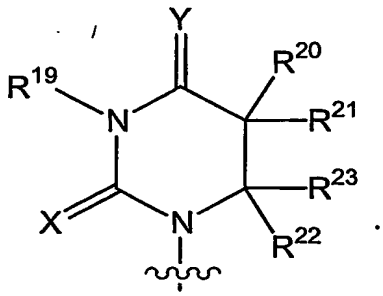
28. The monomer of claim 1, wherein X^2 is $-OC[OCH_2CH_2OC(O)CH_3]_2$; R^{27} is CH_3; R^{28} is $(CH_3)_2CH$-; X5' and X5" are trimethylsiloxy; X5"' is cyclododecyloxy; and B is:



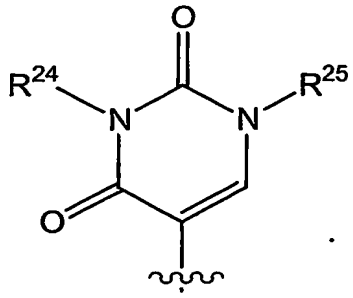
29. The monomer of claim 1, wherein X^2 is $-OC[OCH_2CH_2OC(O)CH_3]_2$; R^{27} is CH_3; R^{28} is $(CH_3)_2CH$-; X5' and X5" are trimethylsiloxy; X5"' is cyclododecyloxy; and B is:



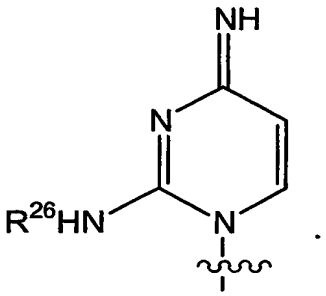
30. The monomer of claim 1, wherein X^2 is $-OC[OCH_2CH_2OC(O)CH_3]_2$; R^{27} is CH_3; R^{28} is $(CH_3)_2CH$-; X5' and X5" are trimethylsiloxy; X5"' is cyclododecyloxy; and B is:



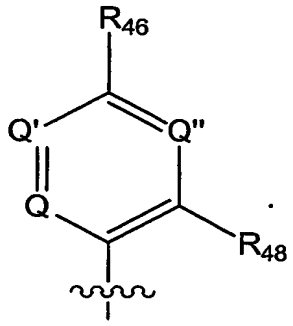
31. The monomer of claim 1, wherein X^2 is $-OC[OCH_2CH_2OC(O)CH_3]_2$; R^{27} is CH_3; R^{28} is $(CH_3)_2CH$-; X5' and X5" are trimethylsiloxy; X5"' is cyclododecyloxy; and B is:



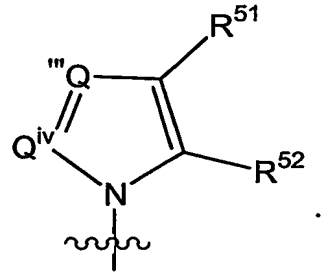
32. The monomer of claim 1, wherein X^2 is $-OC[OCH_2CH_2OC(O)CH_3]_2$; R^{27} is CH_3; R^{28} is $(CH_3)_2CH$-; X5' and X5'' are trimethylsiloxy; X5''' is cyclododecyloxy; and B is:



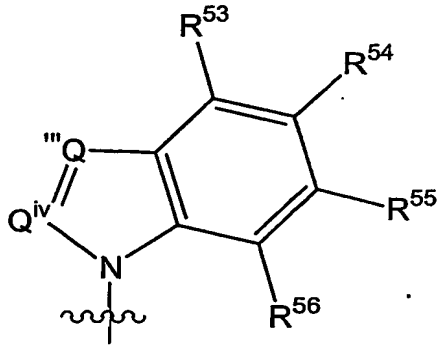
33. The monomer of claim 1, wherein X^2 is $-OC[OCH_2CH_2OC(O)CH_3]_2$; R^{27} is CH_3; R^{28} is $(CH_3)_2CH$-; X5' and X5'' are trimethylsiloxy; X5''' is cyclododecyloxy; and B is:



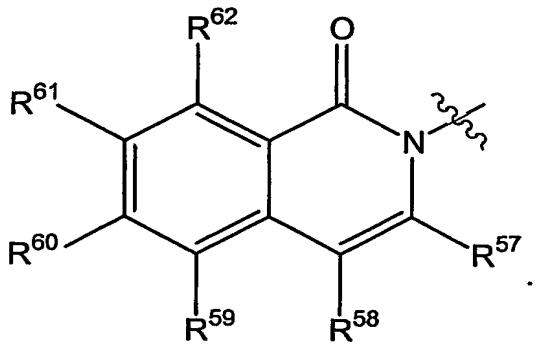
34. The monomer of claim 1, wherein X^2 is $-OC[OCH_2CH_2OC(O)CH_3]_2$; R^{27} is CH_3; R^{28} is $(CH_3)_2CH$-; X5' and X5'' are trimethylsiloxy; X5''' is cyclododecyloxy; and B is:



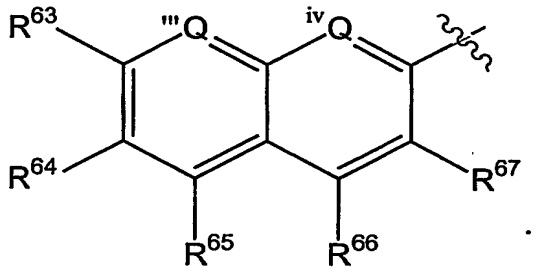
35. The monomer of claim 1, wherein X^2 is $-OC[OCH_2CH_2OC(O)CH_3]_2$; R^{27} is CH_3; R^{28} is $(CH_3)_2CH$-; X5' and X5'' are trimethylsiloxy; X5''' is cyclododecyloxy; and B is:



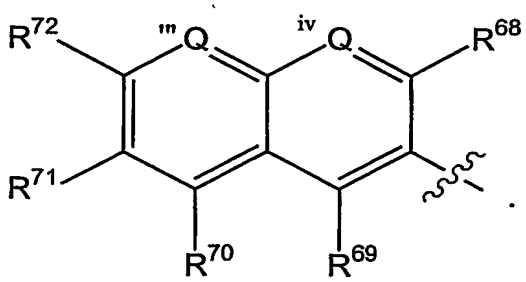
36. The monomer of claim 1, wherein X^2 is $-OC[OCH_2CH_2OC(O)CH_3]_2$; R^{27} is CH_3; R^{28} is $(CH_3)_2CH$-; X5' and X5'' are trimethylsiloxy; X5''' is cyclododecyloxy; and B is:



37. The monomer of claim 1, wherein X^2 is $-OC[OCH_2CH_2OC(O)CH_3]_2$; R^{27} is CH_3; R^{28} is $(CH_3)_2CH$-; X5' and X5'' are trimethylsiloxy; X5''' is cyclododecyloxy; and B is:



38. The monomer of claim 1, wherein X^2 is $-OC[OCH_2CH_2OC(O)CH_3]_2$; R^{27} is CH_3; R^{28} is $(CH_3)_2CH$-; X5' and X5'' are trimethylsiloxy; X5''' is cyclododecyloxy; and B is:



39. The monomer of claim 1, wherein X^2 is $-OC[OCH_2CH_2OC(O)CH_3]_2$; R^{27} is CH_3; R^{28} is $(CH_3)_2CH$-; X5' and X5'' are trimethylsiloxy; X5''' is cyclododecyloxy; and B is anthracenyl.

40. The monomer of claim 1, wherein X^2 is $-OC[OCH_2CH_2OC(O)CH_3]_2$; R^{27} is CH_3; R^{28} is $(CH_3)_2CH$-; X5' and X5'' are trimethylsiloxy; X5''' is cyclododecyloxy; and B is pyrenyl.

41. The monomer of claim 1, wherein B is selected from the group consisting of:

2-aminoadeninyl

2-methyladeninyl,

N6-methyladeninyl,

2-methylthio-N6-methyladeninyl,

N6-isopentenyladeninyl,

2-methylthio-N6-isopentenyladeninyl,

N6-(cis-hydroxyisopentenyl)adeninyl,

2-methylthio-N6-(cis-hydroxyisopentenyl) adeninyl,

N6-glycinylcarbamoyladeninyl,

N6-threonylcarbamoyladeninyl,

2-methylthio-N6-threonyl carbamoyladeninyl,

N6-methyl-N6-threonylcarbamoyladeninyl,

N6-hydroxynorvalylcarbamoyladeninyl,

2-methylthio-N6-hydroxynorvalyl carbamoyladeninyl,

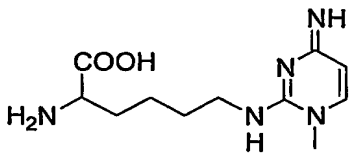
N6,N6-dimethyladeninyl,

3-methylcytosinyl,

5-methylcytosinyl,

2-thiocytosinyl,

5-formylcytosinyl,



,

N4-methylcytosinyl,

5-hydroxymethylcytosinyl,

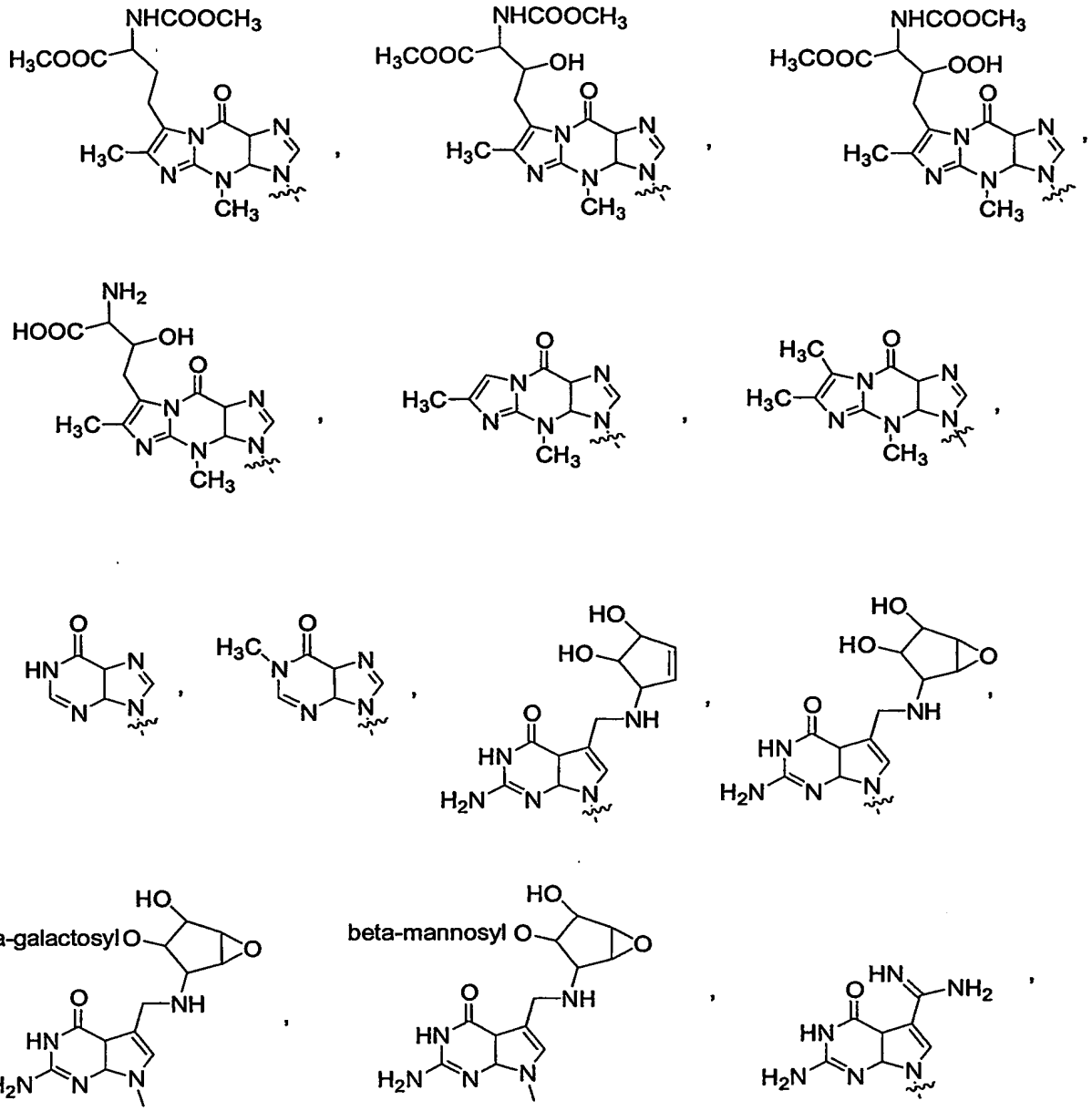
1-methylguaninyl,

N2-methylguaninyl,

7-methylguaninyl,

N2,N2-dimethylguaninyl,

5



N2,7-dimethylguaninyl,

N2,N2,7-trimethylguaninyl,

1-methylguaninyl,

7-cyano-7-deazaguaninyl,

7-aminomethyl-7-deazaguaninyl,

pseudouracilyl,

dihydrouracilyl,

5-methyluracilyl,

1-methylpseudouracilyl,

2-thiouracilyl,

4-thiouracilyl,

5-methyl-2-thiouracilyl,

3-(3-amino-3-carboxypropyl)uracilyl,

5-hydroxyuracilyl,

5-methoxyuracilyl,

uracilyl 5-oxyacetic acid,

uracilyl 5-oxyacetic acid methyl ester,

5-(carboxyhydroxymethyl)uracilyl,

5-(carboxyhydroxymethyl)uracilyl methyl ester,

5-methoxycarbonylmethyluracilyl,

5-methoxycarbonylmethyl-2-thiouracilyl,

5-aminomethyl-2-thiouracilyl,

5-methylaminomethyluracilyl,

5-methylaminomethyl-2-thiouracilyl,

5-methylaminomethyl-2-selenouracilyl,

5-carbamoylmethyluracilyl,

5-carboxymethylaminomethyluracilyl,

5-carboxymethylaminomethyl-2-thiouracilyl,

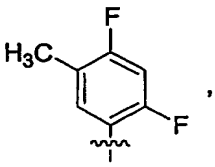
3-methyluracilyl,

1-methyl-3-(3-amino-3-carboxypropyl) pseudouracilyl,

5-carboxymethyluracilyl,

5-methyldihydrouracilyl,

3-methylpseudouracilyl,



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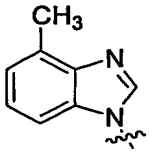

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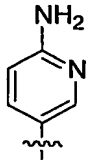

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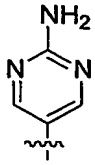

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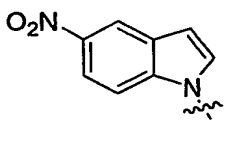

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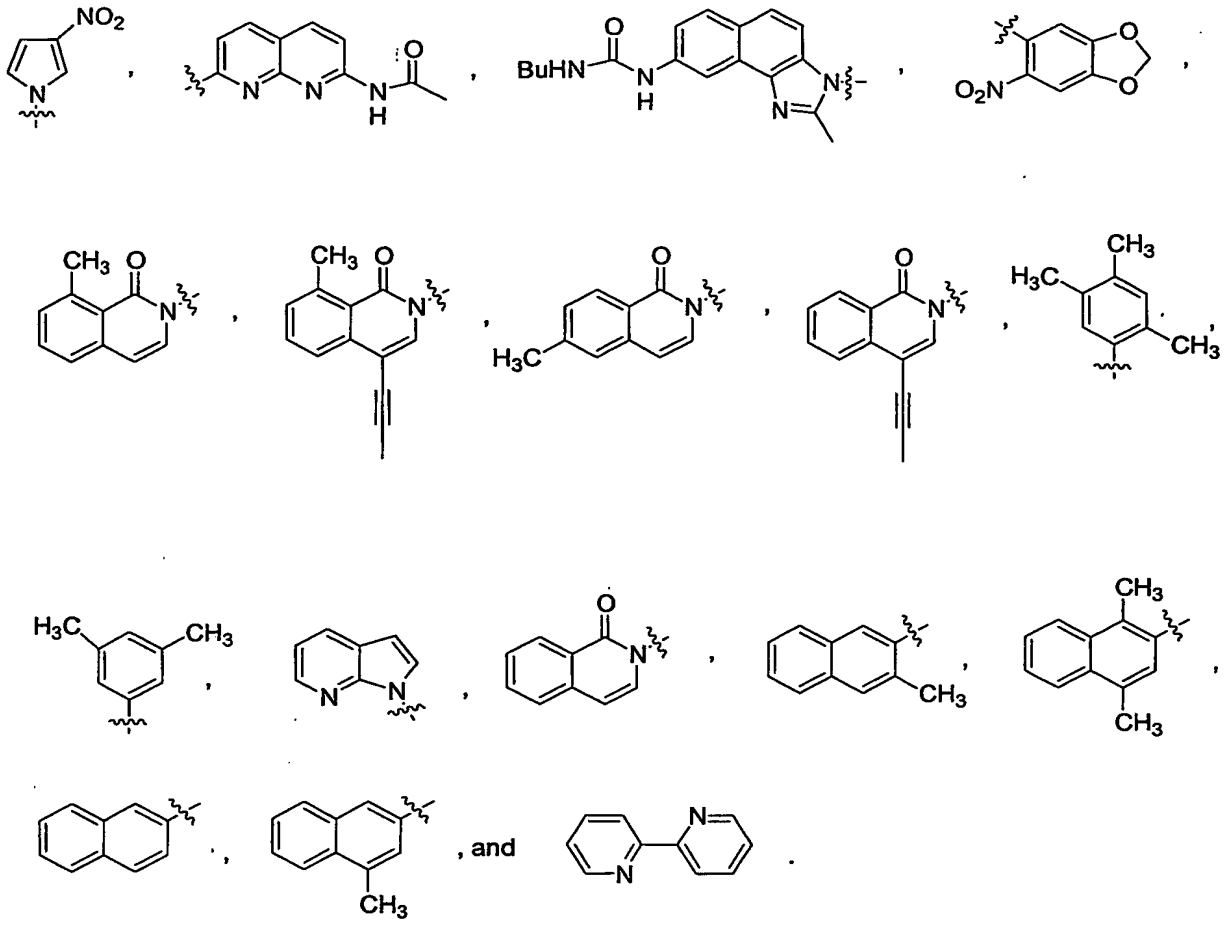


42. The monomer of claim 1, wherein X^2 is $-OC[OCH_2CH_2OC(O)CH_3]_2$; R^{27} is CH_3; R^{28} is $(CH_3)_2CH$-; X5' and X5" are trimethylsiloxy; X5"' is cyclododecyloxy; and B is selected from the group consisting of:

2-aminoadeninyl,

2-methyladeninyl,

N6-methyladeninyl,

2-methylthio-N6-methyladeninyl,

N6-isopentenyladeninyl,

2-methylthio-N6-isopentenyladeninyl,

N6-(cis-hydroxyisopentenyl)adeninyl,

2-methylthio-N6-(cis-hydroxyisopentenyl) adeninyl,

N6-glycinylcarbamoyladeninyl,

N6-threonylcarbamoyladeninyl,

2-methylthio-N6-threonyl carbamoyladeninyl,

N6-methyl-N6-threonylcarbamoyladeninyl,

N6-hydroxynorvalylcarbamoyladeninyl,

2-methylthio-N6-hydroxynorvalyl carbamoyladeninyl,

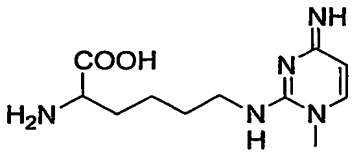
N6,N6-dimethyladeninyl,

3-methylcytosinyl,

5-methylcytosinyl,

2-thiocytosinyl,

5-formylcytosinyl,



,

N4-methylcytosinyl,

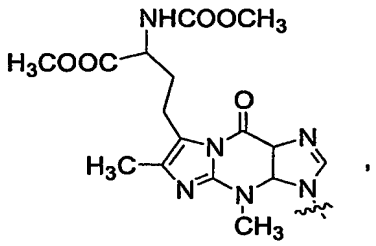
5-hydroxymethylcytosinyl,

1-methylguaninyl,

N2-methylguaninyl,

7-methylguaninyl,

N2,N2-dimethylguaninyl,



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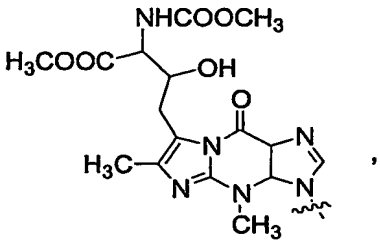

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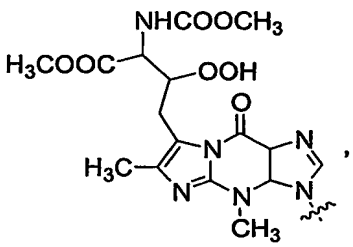

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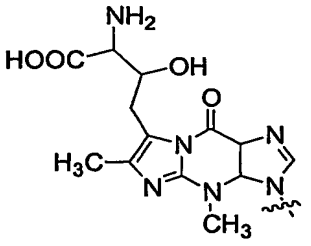

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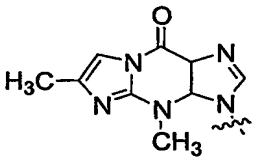

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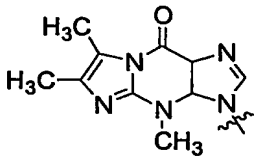

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N2,7-dimethylguaninyl,

N2,N2,7-trimethylguaninyl,

1-methylguaninyl,

7-cyano-7-deazaguaninyl,

7-aminomethyl-7-deazaguaninyl,

pseudouracilyl,

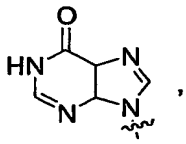
dihydrouracilyl,

5-methyluracilyl,

1-methylpseudouracilyl,

2-thiouracilyl,

4-thiouracilyl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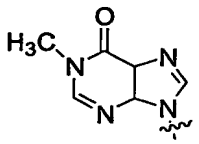
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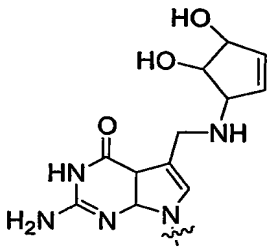
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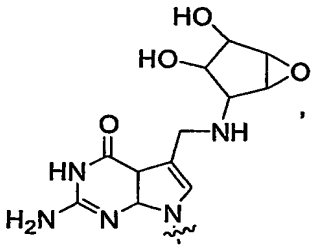
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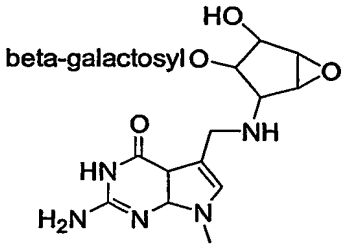
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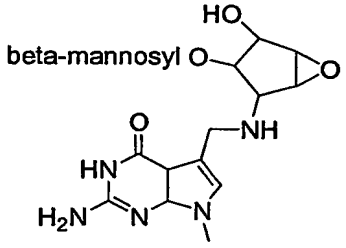
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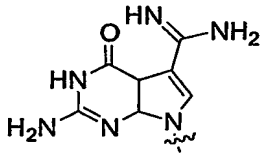
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5-methyl-2-thiouracilyl,

3-(3-amino-3-carboxypropyl)uracilyl,

5-hydroxyuracilyl,

5-methoxyuracilyl,

uracilyl 5-oxyacetic acid,

uracilyl 5-oxyacetic acid methyl ester,

5-(carboxyhydroxymethyl)uracilyl,

5-(carboxyhydroxymethyl)uracilyl methyl ester,

5-methoxycarbonylmethyluracilyl,

5-methoxycarbonylmethyl-2-thiouracilyl,

5-aminomethyl-2-thiouracilyl,

5-methylaminomethyluracilyl,

5-methylaminomethyl-2-thiouracilyl,

5-methylaminomethyl-2-selenouracilyl,

5-carbamoylmethyluracilyl,

5-carboxymethylaminomethyluracilyl,

5-carboxymethylaminomethyl-2-thiouracilyl,

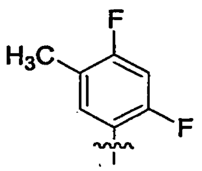
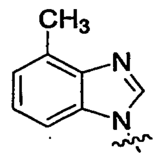
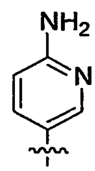
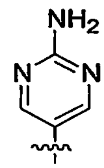
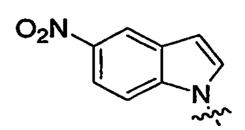
3-methyluracilyl,

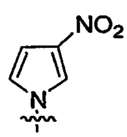
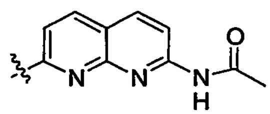
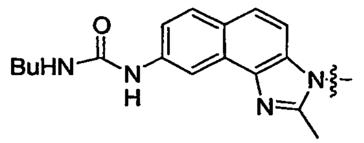
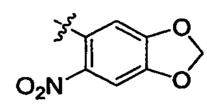
1-methyl-3-(3-amino-3-carboxypropyl) pseudouracilyl,

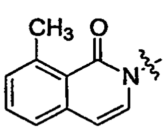
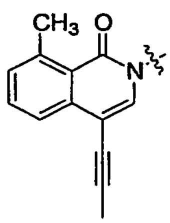
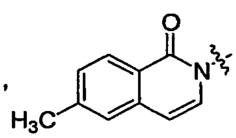
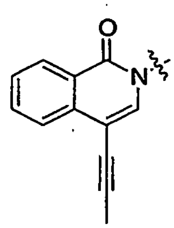
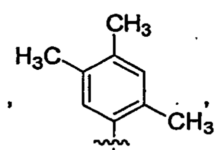
5-carboxymethyluracilyl,

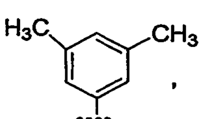
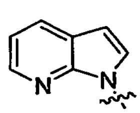
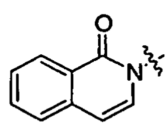
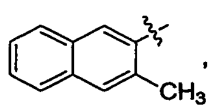
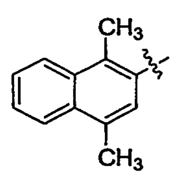
5-methyldihydrouracilyl,

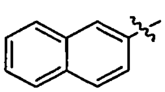
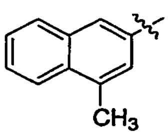
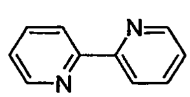
3-methylpseudouracilyl,

 ,  ,  ,  ,  ,

 ,  ,  ,  ,

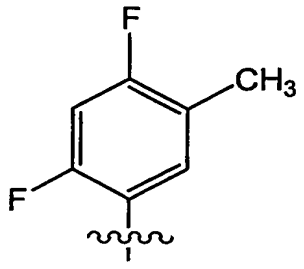
 ,  ,  ,  ,  ,

 ,  ,  ,  ,  ,

 ,  , and  .

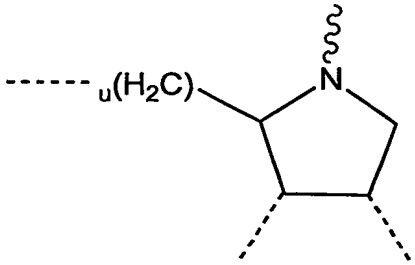
43. The monomer of claim 1, wherein X^2 is fluoro.

44. The monomer of claim 1, wherein B is:



45. The monomer of claim 1, wherein B is substituted or unsubstituted aryl attached to a tethered or untethered ligand.

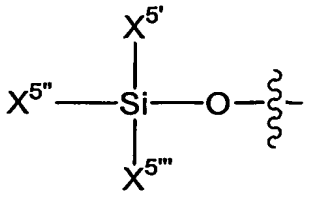
46. A protected monomer having a formula:



in which

u is 1 or 2; the wavy line represents a point of attachment for a ligand or a tethered ligand; and the dotted lines represent points of attachment for a first functionalized hydroxyl group; a second functionalized hydroxyl group; and an unfunctionalized hydroxyl group, a protected hydroxyl group, or hydrogen.

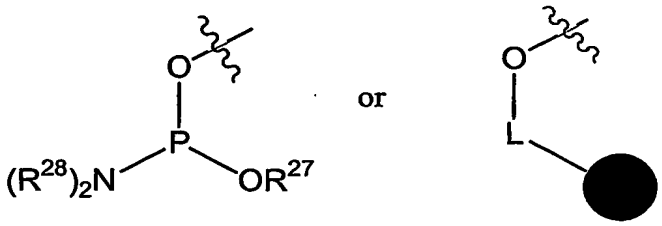
47. The monomer of claim 46, wherein the first functionalized hydroxyl group has the formula:



; in which

$X^{5'}$, $X^{5''}$, and $X^{5'''}$ include at least one alkoxy or siloxy substituent.

48. The monomer of claim 46, wherein the second functionalized hydroxyl group has one of the following formulas:



; in which

R^{27} is C_1-C_6 alkyl optionally substituted with cyano or C_2-C_6 alkenyl; R^{28} is C_1-C_{10} alkyl; ● is a solid or liquid support reagent; and L is a linker.

49. The monomer of claim 46, wherein the ligand is a targeting group.

50. The monomer of claim 49, wherein the targeting group is a lipid, steroid, vitamin, carbohydrate, polyamine, amino acid, peptide, peptide mimetic or cleaving molecule.

51. The monomer of claim 50, wherein the steroid is cholesterol.

52. The monomer of claim 46, wherein the ligand is a diagnostic group.

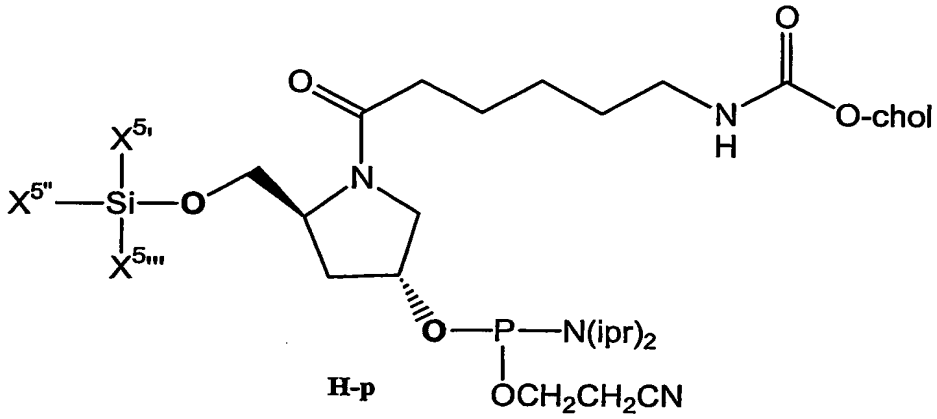
53. The monomer of claim 52, wherein the diagnostic group is biotin, a fluorophore, an antibody or an antigen.

54. The monomer of claim 46, wherein the ligand has a formula $(G)C(=H)NHR^n$, in which G is -O-, -NH-, or $-CH_2-$; H is O or NH; and R^n is H, C_1-C_6 alkyl, C_6-C_{10} aryl, or C_5-C_{10} heteroaryl.

55. The monomer of claim 46, wherein the monomer has a tethered ligand.

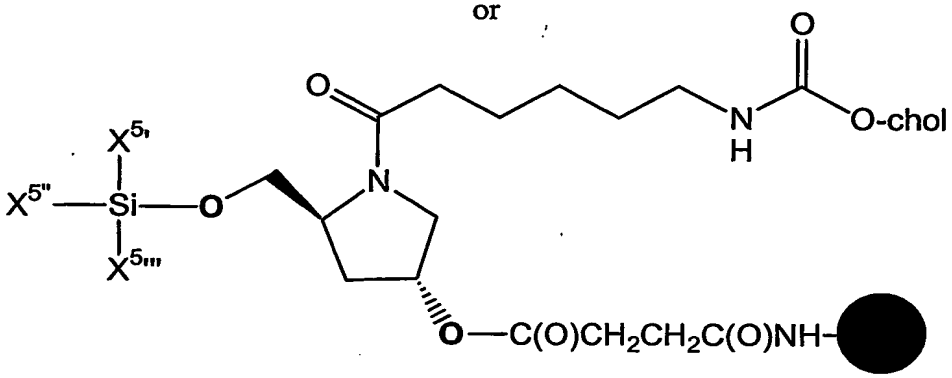
56. The monomer of claim 55, wherein the ligand is tethered with a tether selected from the group consisting of: $-C(O)-(CH_2)_s-C(O)-$(ligand); $-C(O)-(CH_2)_s-C(O)O-$(ligand); $-C(O)-O-$(ligand); $-C(O)-(CH_2)_s-NH-$; $-C(O)-(CH_2)_s-NH-C(O)-$(ligand); $-C(O)-(CH_2)_s-$(ligand); $-C(O)-NH-$(ligand); $-C(O)-$(ligand); $-(CH_2)_s-C(O)-$(ligand); $-(CH_2)_s-C(O)O-$(ligand); $-(CH_2)_s-$(ligand); $-(CH_2)_s-NH-$; and $-(CH_2)_s-NH-C(O)-$(ligand), wherein s is 0-6.

57. The monomer of claim 46, wherein the monomer has the formula:



H-p

or



H-ss

wherein, $X^{5'}$, $X^{5''}$, and $X^{5'''}$ include at least one alkoxy or siloxy substituent, ipr is an isopropyl group, and chol is a cholesterol radical.

58. An iRNA agent having a monomer of claim 1 or 46.

59. A method of making an iRNA agent, the method comprising providing an iRNA agent having a monomer of claim 1 or 46 and allowing it to anneal to a complementary RNA sequence to form an iRNA agent.